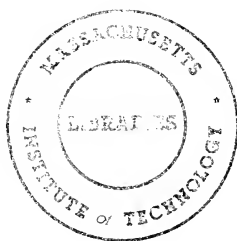


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COGNITIVE STYLE RESEARCH:  
A PERSPECTIVE FOR INTEGRATION

Peter G. W. Keen  
Gloria S. Bronsema

December 1981

CISR No. 82  
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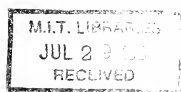
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P. G. W. Keen and G. S. Bronsema 1981

This paper was presented at, and was published in the Proceedings of, the Second International Conference on Information Systems, December, 1981, Cambridge, Mass.

Center for Information Systems Research  
Sloan School of Management  
Massachusetts Institute of Technology



Peter G. W. Keen  
Sloan School of Management  
Massachusetts Institute of Technology

Gloria S. Bronsema  
Harvard University

## ABSTRACT

Cognitive style is a continuing area of interest in MIS research. The work is often criticized for its fragmentation and lack of validity. This paper proposes the uses of a single instrument, the Myers-Briggs Type Indicator (MBTI). It reviews the overall issue of validity and identifies the four steps cognitive style research must accomplish to achieve coherence. It assesses existing research related to those steps, focusing on findings from studies that use the MBTI. It presents data on cognitive style differences among occupational specialties.

## ISSUES OF COGNITIVE STYLE IN MIS RESEARCH

The link between cognitive style and the implementation and use of information systems and models is a recurring theme in MIS/MS research. Studies of cognitive style reflect two central assumptions:

1. There are systematic differences among individuals in terms of perception, thinking, and judgment that significantly influence their choice of and response to information.
2. The difference between managers' and analysts' cognitive styles is a major explanation of difficulties in implementation.

style research in MIS. The work is fragmented and uses a variety of overlapping constructs and measures. The empirical results are generally equivocal and inconsistent and, all in all, the research has not generated convincing evidence to support the hypotheses implicit in the two assumptions listed above (Taylor and Benbasat, 1980; Wade, 1981).

That said, the cognitive style theme is of persistent interest and influence in MIS. The work of Churchman (1964), Churchman and Schainblatt (1965), and Mason and Mitroff (1973) constitutes an unfinished program for research on the dynamic interaction between information and personality. Taylor and Benbasat's critique of previous studies (1980) points to the high potential payoff from "sound research into the psychological characteristics of information system users," though it justifiably highlights "inadequately formulated theory," "use of a great many inadequately validated measuring instruments," and "faulty research designs."

Table 1 traces the evolution of cognitive

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\*We, the authors, wish to thank Roberta Fallon for her time, patience, and contributions to this paper.

Table 1. The Evolution of Cognitive Style Research in MIS

Author	Focus	Conclusions
Churchman & Schainblatt (1965)	Mutual understanding	Individuals ignore information presented in format incompatible with cognitive style.
Doktor (1970)	Influence of education on cognitive style	
Huysmans (1970)	Analytic v. intuitive rating of C.S. by judges	Analytics reduce problems to underlying relationships expressed in explicit modes; supports Churchman & Schainblatt. People prefer information presented in keeping with their cognitive style.
Doktor & Hamilton (1973)	EFT studying problem solving	Managers are less analytical than students; report selection behavior of both students and managers was independent of cognitive style Contradicts Lusk's (1973) findings. Students selection = independent of C.S.
Lusk (1973)	EFT hypothesis: students will be less analytical than experienced analysts	Report format important only for the inexperienced (students) Lusk - 1973.

Table 1 (continued)

Author	Focus	Conclusions
Keen (1973)	Information gathering/evaluation--2 dimensional Jungian psychological type for managers	
Vasarhelyi (1977)	stated preferences (self report questionnaire) analytic v. intuitive	Some CS hypotheses not supported--heuristics do not prefer qualitative or unstructured information more than analytics. More discriminating measure needed.
Barrett (1978)	Minnesota self report questionnaire	
Zmud (1978)	Analytic v. intuitive; correlates Minnesota self-report questionnaire with MBTI	Analytics are theoretical, not experiential; thinking, not feeling; controlled, not spontaneous. Few of C.S.instruments correlate.
Benbasat & Dexter (1979)	Value/events hypothesis of Sorter EFT/production-inventory simulation	C.S. interacts significantly with information support in determining behavior.

The aim of this paper is to make a case for the use of the Myers-Briggs Type Indicator as the base for cognitive style research.

1. It is based on a theoretically strong paradigm of Psychological Type derived from Jung that has been of substantial influence on research in or related to the MIS field (Mason & Mitroff, 1973, Churchman, 1971, Kilman and Mitroff, 1976, and de Waele 1978). All provide a rich, pragmatic, philosophical discussion of Type theory in relation to information and decision aids. It is worth noting that cognitive style research effectively began within this tradition, with Churchman's (1964) and Churchman & Schainblatt's (1965) exploration of mutual understanding between analyst and manager.
2. The MBTI is a reliable measure. While Stricker and Ross (1964) question some aspects of the MBTI's construct validity, there is a general agreement in the literature on psychological testing that the MBTI is reliable and well-designed. It is also backed up by large-scale data banks and surveys (McCaulley, 1977). The MBTI has strong predictive validity (Myers, 1980). There have been no criticisms of its convergent or discriminant validity.
3. The empirical results of Ghani (1980), Henderson and Nutt (1980), Mitroff and Kilman (1976), and others indicate that the MBTI discriminates behavior relevant to information systems design and use.
4. MBTI data collected by the authors of this paper and taken from other sources point to significant and

sometimes surprising differences between occupational types and job levels among managers, professionals, and people in complex, specialized jobs. The data were gathered over a five-year period. The authors have felt no incentive until recently to publish the results, even though they are statistically significant ( $P < .05, .01, .001$ ). Basically, they show that specialized jobs attract people of specialized cognitive styles. These results are of importance only if it can also be shown that differences in cognitive style clearly relate to behavior relevant to information systems (item 3 above). It is not enough simply to point to differences.

The central argument of this paper is that the MBTI provides a valid theory and measure of cognitive style. Bagozzi (1980) identifies six aspects of validity in behavioral measures:

1. Conceptual Validity. Does the theory make sense and the measurement relate to it and vice versa?
2. Construct Validity. Does the instrument truly measure the theoretical construct?
3. Convergent Validity. Do the instruments claiming to measure the same thing correlate adequately?
4. Discriminant Validity. In turn, do they clearly not correlate with instruments measuring other factors?
5. Predictive Validity. Can the measures be used to predict relevant behavior?

6. Nomological Validity. Does the specific construct relate to a wider theoretical scheme?

In trying to establish any paradigm, the researcher has to address all these issues. Most cognitive style research has tackled only the first and fifth (conceptual and predictive). Bagozzi's framework is useful for evaluating candidate models of cognitive style. Apart from the MBTI, only one measure, Witkin's Embedded Figures Test (EFT) (1964) and variations on it, seems to merit serious consideration as a general base for cognitive style research in MIS.

The EFT is based on Witkin's field dependence/independence model, which has been widely used in experimental research in MIS (Lusk, 1973; Doktor and Hamilton, 1973; Benbasat and Dexter, 1979). This paper makes the case for the MBTI and rejects the EFT as not valid for MIS research. This may or may not be fair, but the case for the Witkin model must be made in terms of Bagozzi's categories of validity. This paper clarifies the issues and provides a challenge for those who feel Witkin's model and the EFT are more suitable.

There are four interrelated steps needed to move cognitive style research from fragmentation to coherence, and from plausibility to validity:

1. Define a conceptually meaningful paradigm of cognitive style.
2. Develop a reliable measure.
3. Establish that the measure discriminates behavior relevant to the development and use of information systems.
4. Demonstrate that analysts and users or managers differ significantly in terms of style.

The structure of this paper corresponds to the sequence of steps outlined above:

1. Define a conceptually meaningful paradigm. The second section discusses the main paradigms of cognitive style in MIS research. The third section describes key conceptual and psychometric issues and links cognitive style to the MBTI.
2. Develop a reliable measure. The fourth section reviews the MBTI, focusing on definitions and construct, and statistical validity.
3. Demonstrate the measure discriminates relevant behavior. The fifth section summarizes applied research using the MBTI.
4. Demonstrate analysts and users/managers differ significantly. The sixth section presents data on career specialization from a range of sources. The results challenge the basic hypothesis that managers and analysts in general differ in style. There are significant variations across functional areas and job levels. Top managers seem, surprisingly, different as a group than middle managers and MBA's. A sharper definition of "manager" or "user" is needed in MIS research. The final section summarizes the case for the MBTI as a valid measure and briefly contrasts it with the EFT.

## PARADIGMS OF COGNITIVE STYLE

Kogan (1976) provides a broad definition of cognitive style:

The construct of cognitive style has been with us for approximately a quarter of a century and it continues to preoccupy psychologists

working in the interface between cognitive and personality. There are individual differences in styles of perceiving, remembering, thinking, and judging, and these individual variations, if not directly part of the personality are at the very least intimately associated with various noncognitive dimensions of personality.

Messick (1970) identifies nine cognitive styles. Kogan (1976) distinguishes three types of models, performance-based, developmental (one mode of style is more "advanced" than the others), and value-neutral (neither extreme of the spectrum is "better"). Most models are bipolar e.g., reflectivity-impulsivity (Kagan and Kogan, 1970), field dependence-independence (Witkin, Goodenough, & Karp, 1967), convergence-divergence (Hudson, 1966), and cognitive simplicity-complexity (Bieri, 1961). Most of the models are based on developmental theory and their measures calibrated from studies of seven to eighteen year olds. Cognitive style is seen as uncorrelated with intelligence, as measured by IQ tests. Style is the result of divergent psychological growth that results in consistent, differentiated traits and strategies.

Almost all the MIS research on cognitive style falls into the following categories in terms of conceptual base:

1. the Witkin field dependence-independence model
2. the converger-diverger construct (Hudson)
3. cognitive complexity theory
4. the MBTI

Table 2 summarizes the main definitions and measures in each category.

There is substantial overlap among the models and, frequently, the labels they employ. The use of bipolar constructs is common. Most MIS studies contrast an analytic or systematic style with an opposite one: intuitive or heuristic (Huysmans, 1970; Barrett, 1978). Most use ad hoc measures, or adopt tests from other sources. Table 2 lists examples. As exploratory research, this strategy is acceptable. Huysmans, Doktor, and Keen (1973), for example, were mainly concerned with demonstrating the value and applicability of the cognitive style paradigm; measurement was a secondary issue. The lack of valid measures, however, surely explains why there has been no follow-up to their work.

Many of the bipolar models provide no real conceptual discussion. Even those based on Witkin and the EFT focus on experimental data rather than on underlying theory (Dermer, 1973). More importantly, regardless of the labels used, most of these models can be subsumed into Hudson's converger-diverger framework.

If the EFT is a measure in search of a theory (Zigler, 1963) Hudson's formulation is the reverse. He uses a variety of pencil-and-paper tests which do not have clear norms. There is no discussion of construct, discriminant, or convergent validity, but his book Contrary Imaginations, is stimulating and rich in insight and implication. It is hard to see how any existing analytic/heuristic model not based on Witkin or Hudson adds to either our conceptual or empirical understanding of cognitive style.

Cognitive complexity theory and construct theory are not models of style but address the same overall issues. They are Type I models (performance-based) using Kogan's distinction. Complexity is better than simplicity (Witkin's model also falls into this category).

Table 2. Definitions and Measures of Cognitive Style Categories

Field Dependence-Independence

Focuses on perceptual behavior, an individual's ability to analytically isolate an item from its content, its field. Field-dependent people are likely to be particularly responsive to social frames of reference (heuristic), while field independent people are more analytic (Vitkin).

Measures: EFT (Embedded Figures Test)

Converger-Diverger

In convergent thinking the aim is to discover the one right answer. It is highly directed and logical thinking. In divergent thinking the aim is to produce a large number of possible answers, none of which is necessarily more correct than the others (Hudson).

Measures: ad hoc tests; creative uses of objects

Cognitive Complexity Theory

Measurement of the number of dimensions individual employ in constructing their social and personal world. Individuals at the complexity end of the spectrum will differentiate greater numbers of dimensions than will those at the simplicity end of the spectrum.

Measures: performance-based test; paragraph completion

MBTI (Myers-Briggs Type Indicator)

Looks at the ways people prefer to perceive and judge their world. Categorizes sixteen psychological types. A person's overall psychological type is a result of test scores received on each of the four separate preferences (introvert or extravert, sensing or intuitive, thinking or feeling, judging or perceiving).

Measures: multiple-choice pencil and paper questionnaire

Larreiche (1974), Carlisle (1974), and Stabell (1974) used complexity theory in their studies of Decision Support Systems, drawing on Bieri (1961) and Schroeder, Driver, and Steufert (1967). Their work has not been followed up, mainly, we deduce, because of the gap between paradigm and measure. Schroeder, et. al's, Paragraph Completion test lacks psychometric validity.

Wade (1981) and Taylor and Benbasat (1980) provide comprehensive critiques of research in all four categories. Table 3 summarizes our own assessment of the validity of the first three categories using Bagozzi's classification. Of course, it must be shown that the fourth category of cognitive style research, based on the MBTI, does not suffer the same inadequacies. This will be done in the fourth section of this paper. The points to be made here are:

1. There is a consistent gap between paradigm and measure in the MIS cognitive style research.
2. The measures are largely ad hoc.
3. The bipolar constructs are redundant and can be subsumed into either Witkin's or Hudson's frameworks.

Other general criticisms can be added; tests of analytic-heuristic styles correlate poorly (Vasarihelyi, 1977; Zmud, 1978), as do those measuring cognitive complexity (Stabell, 1974). Worse, the experimental results are generally uninteresting or inconsistent (Taggart and Robey, 1979). This is especially true of studies using the EFT (Taggart and Robey, 1979).

## CONCEPTUAL AND PSYCHOMETRIC ISSUES

McKenney and Keen present a two-dimensional model of cognitive style (1974) that

has many overlaps with other models and that suffers from several of the weaknesses discussed above. It is briefly described here since work by Keen (1973) and subsequent unpublished surveys confirm several points central to the argument of this paper:

1. The psychometric issues in development and application of paper-and-pencil tests are immense and must be avoided by the use of established, not ad hoc measures.
2. The analytic/heuristic and systematic/intuitive dichotomies reflect a more general converger/diverger distinction.
3. The MBTI is as good or better a method for measurement as the elaborate set of tests used by Keen (1973).
4. As Wade points out, "while McKenney and Keen claim that a cognitive style is different from a personality type, on the surface their construct would appear to have a lot in common with the Myers-Briggs sensing/intuition and thinking/feeling dimension" (1981).

Wade's criticism is legitimate. Even in his initial study (1973), Keen found that the MBTI discriminated certain aspects of style better than the battery of tests he used for the main study. These tests were cumbersome to administer (1 and 1/2 hours plus 1 hour to score), and provided subjects with little useful feedback. There were no population norms, and cutpoints were situationally selected. In later studies Keen found that while the overall correlations among the tests were similar for different populations, absolute scores were distorted by factors of speed and recent experience with test-taking.

The strength of the McKenney-Keen model

Table 3. An Assessment of the Validity of Cognitive Style Paradigms in MIS

<u>Cognitive Complexity</u>		
Conceptual Base:	Well-articulated theoretical base, but not rooted in psychological theory	Bieri (1961)  Schroeder, Driver & Streufert (1967)
Measure:	Paragraph Completion No Calibration/norms No formal measures of psychometric validity	
Comments:	No clear validity	
<u>EFT Analytic-Heuristic</u>		
Conceptual Base:	Mainly Witkin (1964)	Nisbett & Temoshok (1976)  Vasarhelyi (1977)  Huysmans (1970)
Measure:	EFT or ad hoc tests Spatial skills in narrow tasks	
Comments:	Confusion. No correlation. Basically a subset of converger-diverger.	

Table 3. (Continued )

<u>Converger-Diverger</u>	
Conceptual Base:	Hudson (1966)
Measure:	Ad hoc tests Creative uses of objects
Comments:	Well-articulated study of English schoolboys-- limited application. No formal calibration or validity.

is that it is not bipolar. Unidimensional models seem unlikely to capture the complexity of the problem-solving behavior of skilled, well-educated people of varied academic backgrounds. The McKenney-Keen model uses two dimensions:

1. *perception* information gathering: receptive-perceptive
2. *judgment* information evaluation: systematic-intuitive

These correspond closely to the distinction between perception and judgment that is the basis of the MBTI. Keen concluded that his measures did not capture the perceptual/information-gathering dimension well. Pencil-and-paper problem solving tests elicit clear behavior and performance, and these are well-suited to measuring judgment/information evaluation. Perceptual processes are less easy to observe and classify.

More important than these pragmatic issues, the conceptual base for the McKenney-Keen model was casually reported. It was mainly derived from the

development theory of Bruner (1966) and, via induction, Piaget. A central aim was to present a value-neutral model (Type III in Kagan's classification).

The McKenney-Keen model views cognitive style as a set of consistent and differentiated strategies that largely evolve in response to specialized information-processing and educational environments (Altemeyer, 1966). These become abilities or disabilities depending on the match between the individual's style and the demands of the problem solving context --the most obvious of these contexts is one's job (Keen, 1974). Wade's comment is correct; the McKenney-Keen model is basically one of psychological type. Its distinction between information-gathering and information-use indicates that cognitive style reflects complex behavior that is not captured by a single, simple dimension.

Mason and Mitroff's influential paper on a Program for Research in Management Information Systems (1973) was published after Keen completed his analysis which included only a hasty page alluding to it. It now seems clear that the Jungian theory of

Type which Mason and Mitroff present is very close to the aims and concepts of the McKenney-Keen model. Subsequent experiments involving junior college students, managers, and MIS professionals confirm the authors' view that the model is redundant. While it still seems correct in its overall formulation, the substitution of the MBTI provides reliability and ease of measurement and adds nomological validity, since the philosophic base and empirical application of the MBTI analytic/systematic and heuristic/intuitive dichotomy rely on similar definitions and methods, they too can be subsumed into the MBTI which adds an essential perceptual dimension to their simple one of problem solving.

If cognitive "style," as most MIS researchers seem to intend, is to be viewed as value-neutral, the performance-based Type I models also seem less acceptable than ones that equate style with personality type. Nisbett and Temoshok (1976) and Maccoby and Jacklin (1974) make a strong case that Type I models are completely invalid; they really measure "performance on a simple task or narrow set of related tasks" (Nisbett and Temoshok, 1976).

### THE MYERS-BRIGGS TYPE INDICATOR (MBTI)

There is a huge literature on the MBTI. A 1980 bibliography (CAPT) lists almost 600 references, many of which relate to education and occupational choice, especially in medicine (McCauley, 1977). The instrument was developed in the 1940's through 1960's by I. Myers. It has been continuously refined since then; the Center for Applications of Psychological Type at the University of Florida built a database of over 75,000 subjects between 1970 and 1976 and carried out a number of longitudinal studies.

The MBTI is based on Jung's theory of Psychological Type (1923). Jung was con-

cerned with the conscious aspects of personality, especially how people take in information and how they decide what to do with it. He assumes that much apparently random variation in human behavior is actually orderly and consistent. Jung distinguishes between two opposite modes:

#### 1. "Finding Out"

Sensing: preference for known facts; reliance on concrete data and experience

Intuition: looking for possibilities and relationships; focus on concepts and theory

#### 2. "Deciding"

Thinking: judgments are based on impersonal analysis and logic

Feeling: judgments are based on feelings and personal values

Mason and Mitroff (1973) relate the Jungian scales specifically to information systems:

Each of these types has a different concept of "information," and this is important for MIS design. If one is a pure Thinking type, information will be entirely symbolic, e.g., some abstract system, model, or string of symbols devoid of almost any empirical content. If one is a Sensation type, information will be entirely empirical, devoid of almost any theoretical content. Thus, Sensation types speak of "raw data," "hard facts," "numbers." For Intuition types, information will be in the form of "imaginative stories," "sketches of future possibilities." Information for Feeling types takes the form of "art," "poetry," "human drama," and especially "stories that emphasize or have a strong moral

component." What is information for one type will definitely not be information for another. Thus, as designers of MIS, our job is not to get (or force) all types to conform to one, but to give each type the kind of information he is psychologically attuned to and will use most effectively.

Jung defined two other dimensions of type:

1. Relative interest in the outer versus inner world: Introversion: one's main interest is in the inner world of concepts and ideas.

Extraversion: one is more involved with the outer world of people and things.

2. Dealing with the world around us: Judging: "living in a planned, decided, orderly way, wanting to regulate life and control it" (Myers, 1976).

Perceiving: "living in a flexible, spontaneous way, wanting to understand life and adapt to it."

This classification results in four independent dimensions and, hence, sixteen types:

EI: Extraversion (E) - Introversion (I)

SN: Sensing (S) - Intuition (N)

TF: Thinking (T) - Feeling (F)

JP: Judging (J) - Perceiving (P)

An ENFJ, for example, is extraverted, intuitive, feeling, and judging.

The MBTI is a self-report questionnaire consisting of 126 forced-choice questions (Form G). Shorter versions have been used by Mitroff, Slocum (1978), Kilmann and Taylor (1974).

Results are reported in terms of "preference" scores. Jung stressed that a mature individual can use the eight modes (four scales x two opposites) as the occasion demands, but that people have consistent preference for one pole on each dimension. The strength of the preference is shown by taking a numeric score between 1 and 67. Myers (1962) states "the letter is considered the most important part of the score, as indicating which of the opposite sides of his nature the person prefers to use and, presumably, has developed—or can develop—to a higher degree. ...The numerical portion of a score shows how strongly the preference is reported, which is not necessarily the same thing as how strongly it is felt...Each person is classed in positive terms, by what he likes, not what he lacks. The theory attaches no prior value judgment to one preference as compared with another, but considers each one valuable and at times indispensable in its own field."

Myers (1962) provides a detailed description of the construction of the MBTI, together with data to support its validity. The only technical problems seem to be:

1. The SN & JP scales are not orthogonal.
2. The TF scale has had to be recalibrated to reflect the fact that "feeling responses may be more acceptable or popular among younger Americans than they were twenty years" (Myers, 1976). (See also Stricker and Ross, 1964.)

Split-half reliabilities in samples of high school and college students (N = 26 to 100) are in the .80 range, and median item-type tetrachoric correlations .61 (N = 1101) for 11th and 12th graders and .48 for 4th and 5th (N = 264). The indicator has been subjected to a strict series of internal consistency analyses, mainly using large samples of adults. Checks on internal and

longitudinal validity have been carried out that suggest that the MBTI is reliable (Buros, 1970; Lake, Miles, & Earle, 1973).

The MBTI is designed to maximize accuracy at the center rather than the extremes of each index; this is consistent with the emphasis on the letter (E, I, S, N, etc.) rather than the score. The MBTI has no zero point; scores are converted by doubling the difference and adding or subtracting 1, so that the final preference strength is always an odd number.

The scoring method eliminates distortions caused by students omitting to answer questions and by social desirability responses (Myers, 1962). Myers presents substantial evidence to support the choice of division points, e.g., between E and I, (Myers, 1962) to address criticisms by Stricker and Ross (1962) concerning criterion groups and the interpretation of regression results. It is central to the theory of type that the regressions reflect a dichotomy; i.e., that an E is different from an I, S from N, etc.

The best method thus found...is by plotting the regression of a dependent variable separately upon the two halves of an index.

...The crucial question is whether the observed disparities in level and/or slope...are better explained by the hypothesis of two different populations (Myers, 1962).

One result of the dichotomous construction and the consequent reliance on the letter rather than the score has been the very limited use of parametric statistical analysis in empirical MBTI research. Many studies report no tests of significance; most others use simple chi-square statistics or related indices showing observed to expected frequencies based on large samples from Myers (McCaulley, 1976). This

obviously poses problems of comparability and generalization of results.

Mason and Mitroff seem to have been the first to use the Jungian theory of type in MIS and reference the MBTI. In later studies Mitroff and Kilmann (1975), and Kilmann and Mitroff (1976) use a variant of the MBTI but do not report detailed statistics. The Berkeley tradition of Churchman and Mitroff focuses on the theoretical and philosophical implications of the Jungian framework (see also de Waele, 1978).

Keen (1973) and others explicitly interested in empirical aspects of cognitive style (Henderson and Nutt, 1980) largely accept the labels of the MBTI with little discussion of the underlying theory. Myers in effect sanctions the empirical use of the MBTI independent of Jungian theory: "the personality differences it reflects are not at all theoretical, being a familiar part of everyday life. The theory simply offers a set of reasons for them, which may or may not matter in a given context" (Myers, 1962).

The important issue of the relation between personality "type" and cognitive "style" is discussed in de Waele, Mason and Mitroff, and Mitroff and Kilmann (1978). Kagan's distinction between performance-based and value-neutral models of style seems relevant. Stabell makes the telling point that cognitive style is a theory of external behavior, (unlike cognitive complexity theory which focuses on internal constructs). Wade, following an exhaustive analysis of a 900-item questionnaire, grouped fifteen personality/cognitive dimensions into three factors (varimax rotation). These load heavily on MBTI scales and derive a two-dimensional model of style that is similar to the McKenney-Keen model and to Hellreigel and Slocum's (1980) adaptation of the MBTI to a cognitive style paradigm. Wade's detailed explication is useful and strongly suggests that a general model of style needs to be bi-dimensional,

not bipolar, and that the basic distinction between information gathering and information evaluation (McKenney & Keen, 1974) is theoretically and empirically sound (Hellriegel and Slocum use exactly these labels; Wade uses fact gathering and information processing).

## EMPIRICAL STUDIES USING THE MBTI

The above discussion of the MBTI relates to steps 1 and 2 in the research sequence described in the first section:

1. Define a conceptually meaningful paradigm of style.
2. Develop a reliable measure.

This section focuses on the next step: establish that the measure discriminates behavior relevant to the use and development of information systems.

This is one of the central overall hypotheses for cognitive style research in MIS. It must be stressed that results using other instruments are equivocal (Taggart & Robey, 1979; Taylor & Benbasat, 1980).

MBTI results are generally reported in terms of letters S, N, T, J, etc., and percentages (a group consists of 60% S's, 40% N's). There is a need for a standardized approach to presenting MBTI results (see the next section). In the discussion here, if significance levels are not shown, they were not reported in the publication referred to.

The MBTI letters will be used here rather than such cognitive style labels as analytic, intuitive, etc. The assumed relation between the McKenney-Keen model and the MBTI is in Figure 1.

The overlap is not complete; the systematic-intuitive distinction and related analytic-heuristic dichotomy is intendedly

broader than that of thinking-feeling. The EI scale has not been found in any MIS study to relate to cognitive style. The JP dimension is interesting in relation to occupational choice (sixth section); it seems to indicate a preference for structure as against flexibility.

Ghani (1980) found that T's and F's differ in terms of performance and time needed in a reasonably complex decision making task using different information formats. T's prefer and do better using tabular and F's graphical displays ( $p < .01$ ). Ghani also used the EFT, but did not find any significant differences. Henderson and Nutt similarly found that T's and F's differed in performance in an operations management task. Keen (1973) reports that cognitive "specialists," individuals previously identified as marked systematics or intuitives, showed predictable differences in problem solving strategies and choice of task ( $p < .05$ ); this is a reclassification of the original data, using the TF scale of the MBTI instead of the original pencil-and-paper tests.

McCaulley and Natter (1974) found significant differences among types in terms of preferred learning activities. Sensing types "need experience with the real thing before learning the symbols verbal and mathematical." N's prefer independent study. While these results do not directly relate to information use, many of McCaulley and Natter's conclusions seem directly transferable to the MIS context.

De Waele (1978) reports a number of relationships between MBTI type and decision making processes in marketing:

1. IP's report problems in "getting things done" and EJ's in handling uncertainty.
2. The N's enjoy problem finding and the S's problem solving.

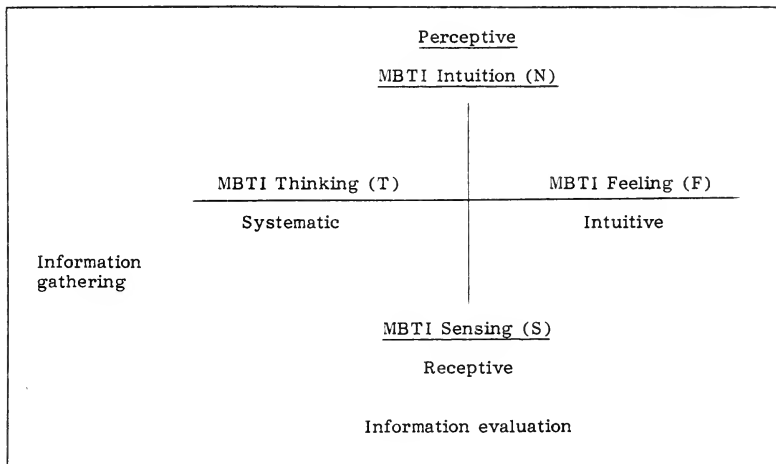


Figure 1.

3. F's enjoy the implementation or execution phase more than T's.

He relates his results to the design of interactive decision aids in marketing.

McKinnon (1962), in a widely cited study, shows that creativity is strongly associated with the N dimension. S's are rarely found in fields associated with research or creative activities (see the next section).

The above results mainly relate to information use and problem solving. Other researchers have focused on issues relevant to mutual understanding and effective implementation. Slocum (1978) found clear differences in change agent strategies. The ST's overall preferred strategy in behavior modification, the SF's transactional analysis, and the NT's survey feedback.

The NF's used a much broader range of strategies, with no one dominating. Mitroff and Kilmann (1976) have produced some striking studies that show different organizations attract different types and vice versa. They used subjects' stories as a means of eliciting their concept of an ideal organization. Managers of the same MBTI type tend to tell the same type of story and thus have similar ideals:

1. ST's stories focus on factual details, the physical features of work, impersonal organizational control, certainty, and specificity.
2. NT's focus on broad global issues and "theories" of organization and are impersonally idealistic.
3. NF's stories are global in scope,

general, personal, and humanistic; their ideal organization has a mission to serve mankind.

4. SF's emphasize fact and precision, human relations, and individual rather than global values.

The work of Mitroff and his colleagues is of particular relevance to cognitive style in that it adds nomological validity. Not only does the MBTI tap characteristics of individual information processing, but it includes noncognitive dimensions that extend the applicability of findings focused on cognitive issues.

Scattered across the MBTI literature is a mass of modest conclusions that add up to very rich profiles. Examples are shown in Table 4 (no attributions are shown here, since they draw on a wealth of references).

## COGNITIVE STYLE AND OCCUPATIONAL SPECIALIZATION

The final component of the four steps for research identified in the first section is: demonstrate that analysts and users of information systems differ significantly in terms of style. This section presents MBTI data across occupations. Keen (1974) suggests that MIS research should focus on cognitive specialization rather than cognitive style, since it is concerned with people and jobs that are not representative of the overall population: managers, whose mean IQ's are 1 to 2 standard deviations above the norm of 100; management scientists, whose training and skills are unusual; and functional specialists, who are likely to bring specialized modes of thinking to their jobs.

Cognitive style research often assumes that managers are different from analysts. That hypothesis does not seem to have been systematically tested. More importantly, the term "manager" covers a wide

range of functions, skills, attitudes, and processes.

The data reported in this section focus on differences in cognitive style in specialized jobs and among business functions and levels of management. Many of the samples were collected by the authors, but the analysis draws on other surveys. The authors' samples are not random. The strategy has been to locate as many specialized occupational groups as possible, particularly ones that require special training and skills of analysis. The authors had six overall hypotheses, several of which are almost axiomatic in the literature on MIS/MS implementation:

1. Intellectual fields will contain a preponderance of N's.
2. Fields in which attention to detail and concrete action are key will attract S's.
3. Technical specialists will tend to be NT's, with few F's and S's.
4. Academics in a given field are more likely to be P's than are practitioners. (The assumption here, not well supported by the data, was that individuals preferring a clear structure and orderly work environment, J's, would be more likely to choose industry than academia).
5. Managers will be predominantly T's and J's.
6. Individuals whose work involves close contact with others will mainly be S's and F's.

There is a distinct problem in choosing a method for determining the significance levels of differences between groups. None of them are representative of the general population, in which the sixteen

Table 4.

1. <u>Dealing with data:</u>		
	S's	N's
New problems	dislike	enjoy
Work pace	steady	in bursts
Reaching Conclusions	complete analysis	jump around
Handling details	patient	impatient
Routine	essential	anathema
2. <u>Getting along with others:</u>		
- presenting sound ideas:		
	S: facts	
	N: possibilities	
	T: logic/principles	
	F: human angle	
- responding to ideas		
	T: impersonal, critical	
	F: values harmony	
- contributing to the discussion:		
	S: getting things done	
	N: thinking things up	
3. <u>Self-perception versus others' perception:</u>		
S	practical, sensible real world, factual, responsible detailed	cold, hard, myopic, nitpicking, plodding, rigid
N	innovative, creative, metaphoric, flexible, adaptable, charismatic, big picture	flaky, dreamer, impractical, fuzzy thinker, flighty, manipulative
T	logical, objective, principled, strong-willed	heartless, remote, unemotional, callous, argumentative, righteous, stubborn
F	understanding, caring, concerned, devoted, compassionate	soft-hearted, soft-headed, illogical, touchy-feely, cause-oriented, wearing one's heart on one's sleeve, busybody

MBTI types are not uniformly distributed. McCaulley uses simple chi-square statistics, comparing the percentage of type (e.g., S's) in a subset of the population against the overall data bank created and maintained at the University of Florida. Since we are interested in the differences between specialized groups and general management we follow her method, but substitute for her base figures a pooled breakdown of the percentage of each type among Wharton (n=232), Harvard (n=107), and Stanford (n=256) MBA's. This figure was chosen as a reference point since the MBA's samples are adequately large (n=604).

There are no firm figures on the distribution of MBTI types across the general population. Myers calibrated Form G of the MBTI, by using 1,114 males and 1,111 females in grades 4 - 12, and validated it using other, generally adult, samples. The Center for Applications of Psychological Type (CAPT) has built a data bank of 75,745 MBTI profiles collected between 1970 and 1976. (For this profile see CAPT baseline figures). This contains a large number of college students. The distribution of types is significantly different from that for MBA's. Most MBTI studies examine specialized groups. The lack of population norms explains why many studies do not report significance levels. In some cases, too, the raw data are no longer available and only aggregate figures on the percentage of subjects in each MBTI category are available. This obviously limits statistical analysis. This weakness is offset by the range of samples for which some information is available. It is only where the issue is the statistical significance of the distribution of types in a particular group that MBTI research is limited to nonparametric analysis. Studies that relate the MBTI to other measures use multivariate techniques, including regression and factor analysis (e.g., Wade).

Table 5 summarizes the distribution of MBTI types across various fields (Appendix A indicates the sources; the authors' samples are marked with an "x"). Some of the samples are very small; one problem in studying specialized occupations is that people in them are hard to locate and are not ubiquitous.

Some general points are obvious from Table 5. The S's skill is in getting things done and the N's in thinking things up. The S is a decision maker and heavily attentive to detailed facts (accountants, bankers, senior executives, judges). In intellectual, scientific, and creative fields N's dominate. There is a clear-cut relationship between intellectual attainment and the SN scale. Among non-college prep high school students 14% are N, for college prep 42%, and among national merit scholars 83% (Myers, 1962).

The differences across occupational specialties are marked. For example, accountants and sales/customer relations personnel are entirely different in terms of the TF dimension (73% versus 11%). Surprisingly, senior executives differ from middle managers and MBA's on the SN dimension. Senior executives are much more concrete and good at getting things done versus thinking things up. This result is based on a limited sample but is important in its implications if it can be confirmed with larger surveys. Six hypotheses were listed above; the results are discussed below.

Hypothesis 1: Intellectual fields will contain a preponderance of N's. This is clearly confirmed. In the technical fields listed, N's constitute a majority; in scientific and intellectual fields, they are generally 90% of the total. One of the seven scientific and intellectual fields is significant at the .01 level, and four are significant at the .001 level for N, using the MBA population as a base.

Table 5. MBTI Types Across Occupational Fields

p shows significance level comparing this group on this scale with combined MBA sample, which is used as indicator of general management MBTI profile.

\* =  $p < .05$

\*\* =  $p < .01$

\*\*\* =  $p < .001$

(chi square statistic, 1 df)

Underlined figure shows which category contains majority of this group.  
e.g., for % S.N 35-65 means 35% S, 65% N; N's dominant.

	<u>n</u>	<u>%S/N</u>	<u>p</u>	<u>%T/F</u>	<u>p</u>	<u>%J/P</u>	<u>p</u>
1. <u>Baseline Figures</u>							
CAPT	75, 745	52-48		37-63		54-46	
x combined MBA samples	604	32-68		71-29		60-40	
2. <u>Technical Fields</u>							
Engineering undergrads	2, 188	35-65	**	67-33	***	35-65	***
Engineering graduates	1, 196	33-67		68-32	*	64-36	**
x Data processing professionals	122	41-59	*	74-26		81-19	***
x Office automation specialists	217	34-66		77-23		74-26	***
Industrial management scientists	26	38-62		73-27		77-23	
x Bell Labs supervisors	24	43-57		71-29		60-40	

Table 5 (continued)

	<u>n</u>	<u>%S/N</u>	<u>P</u>	<u>%T/F</u>	<u>P</u>	<u>%I/P</u>	<u>P</u>
<b>3. Scientific Fields</b>							
Science students	705	17-83	***	69-31		49-51	***
Research scientists	30	0-100	***	77-23		60-40	
<b>4. Intellectual Fields</b>							
Creative writers	17	12-88		35-65	**	27-73	**
Rhodes Scholars	71	7-93	***	45-55	***	37-63	***
Theology	n/a	18-82		28-72		n/a	
Creative architects	40	0-100	***	50-50	**	40-60	**
Mathematicians	28	3-37	**	68-32		n/a	
<b>5. Business</b>							
<b>(a) Functional Areas</b>							
Accountants	n/a	87-13		73-27		n/a	
Bank Employees	n/a	71-29		65-35		n/a	
Sales/customer relations	n/a	92-8		11-89		n/a	
Bank managers	42	70-30	***	55-45	*	52-48	*
Marketing managers	23	43-57		83-17		83-17	*
Management consulting	79	35-65		78-22		72-28	*
<b>(b) Managerial level/training</b>							
Wharton undergraduates	488	72-28	***	69-31		53-57	*
Middle managers	206	27-73		77-23		46-54	***
Senior executives	119	55-45	***	72-28		83-17	***
Owner/managers of small firms	150	86-14	***	81-19	**	75-25	***

Table 5 (continued)

<u>6. Service Professions</u>					
Health-related	n/a	49-51	20-80		n/a
Education	n/a	55-45	19-81		n/a
Counselling	n/a	15-85	15-85		n/a
<u>7. Academics</u>					
x Business school faculty	42	28-73	75-25		54-46
Academic management					
scientists	23	15-85	69-31		58-42
College teachers	60	27-73	45-55	***	n/a
<u>8. Law</u>					
Graduate law students	2248	41-59	73-27	*	57-43
x State judges	112	58-42	66-34	***	78-22
				***	***

Hypotheses 2: Fields in which attention to detail and concrete action are key will attract S's. This hypothesis is also supported. In business function areas, S's are in the majority among accountants, bank employees, and sales/customer relations. Marketing managers, management consultants, MBA's, and middle managers are mainly N's by contrast.

The sample of senior executives is small (119) and consists of attendees at a Stanford University Executive program. The differences between this group and the MBA's on the S/N dimension is significant ( $p < .001$ ). In addition, Hoy's (1979) sample of owner/managers of small firms in Texas shows an even stronger proportion of S's (86%), also significant at the .001 level. However, in a smaller sample of 44 Georgia owner/managers, he found 48% were S. This may be related to differences in education level between the two groups.

The explanation for the unexpected frequency of S's among top managers seems to be that the N's style is well-suited to handling complexity. Managers have to handle a range of functions, planning, forecasting, analysis, and control, while the senior executive is better at dealing with facts and getting things done. A large organization includes many professional and academic disciplines: economists, computer scientists, human resource planners, lawyers, and even historians. Integrating their activities requires the N's willingness to play with concepts and use theoretical frameworks. However, someone has to eliminate, not add, to this complexity and uncertainty. The S's skill is getting things done, demanding the facts and only the facts. S's hold that "matters inferred are not as reliable as matters explicitly stated" (Myers, 1980). The top executive's profile is very close to that of state judges who are decision makers par excellence and whose currency is "fact" (Keen, 1981).

	S		N		T		F		J		P	
Top Executives	58	-	42		66	-	34		78	-	22	
Judges	55		45		72	-	28		83	-	17	

In contrast to senior executives and judges all the technical and professional fields in Table 5 are mainly N's in predominant style; so, too, are most of the managerial ones. There is almost no difference in percent N's between the MBA's, used as the base for comparison, and Bell Labs Supervisors, management scientists, office automation, and data processing professionals. The only difference on the S/N dimension in these populations is the data processing professionals have stronger N scores than the MBA's ( $p < .05$ ). The operating assumption that analysts are different from managers (Grayson, 1973) seems too broad; both are N's. Leavitt's criticism (1975) that both technical specialists and managers are analytic in focus seems more accurate. However, the difference between managers/analysts (N's) and senior executives (S's) is significant at the .001 level.

It appears from Table 5 that the problem in Mutual Understanding (Churchman and Schainblatt) between analysts and managers will be most marked at top levels of the organization and in functional areas involving concrete data and action. Level of education is obviously a relevant factor. The percentage of N's in any group is correlated with educational level (Myers, 1962). Wharton undergraduates are 28% N and Wharton MBA's 65%. Among industry-hired college graduates (Myers, 1962) 50% are N's; this contrasts with the 68% for the MBA population. The strikingly large fraction of S's (86%) in Hoy's sample of owner/managers of small firms may reflect differing education levels. The subjects in his sample where S's are 48%, were attendees at a continuing education course at the University of Georgia.

The senior executives and state judges are

highly educated: many of them have advanced degrees. Thus, while the executive sample is not random but a "convenience" one, education level is not a likely explanation of executives' substantial difference from other educated managers. This result is suggestive only and needs confirmation from more systematic sampling; if it is confirmed, it has some interesting implications.

1. Top managers on the average are not just promoted middle managers, but individuals whose concreteness, pragmatism, and emphasis on getting things done make them stand out from the middle managers and MBA's who are more focused on concepts and planning.
2. Analysts and top managers could hardly differ more in terms of how they view data.
3. The top manager's view of the world is relatively narrow and unsympathetic to the theories and methods of the analytic decision sciences.

Hypothesis 3: Technical specialists will tend to be NT's with few F's and S's. This restates a basic assumption of cognitive style research: the analyst's preference and skill are in concepts and systematic thinking. In technical and scientific fields, about 70% are T's. This is roughly the same for business functions and managerial levels, including senior executives. Again, this suggests that analysts and managers are not as different as the implementation literature assumes. Contrasts to the analysts come by looking at the service professions (counseling, education, and health-related) and intellectual fields where F's predominate.

The authors make the conjecture that the claim that a sizeable faction of managers operate "intuitively" is misleading. The

intuitive strategy described by McKenney and Keen is close to the F's mode of thinking; this is intellectually complex, highly verbal, and relies on analogy (Keen, 1973). Writers, Rhodes Scholars, theologians, college teachers, and educators are F's.

De Waele's study of marketing managers highlighted the role of experience in decision making. S's are highly pragmatic and action oriented; they distrust abstractions. We suspect that it is the S's among managers who speak of "gut feel" and that the gap in mutual understanding is one of S versus N: reliance on experience versus concepts. Myers discusses mutual understanding, Type, and marriage, and argues that the SN scale relates to seeing things the same way: "This does more to make a man and woman understandable to each other than a shared preference on EI or TF or JP." Our data also suggest that because the S/N dimension is most different between managers/analysts and senior executives, it is most likely to cause differences in understanding between the two groups. The T scale seems to offer little, if any, discriminating power in business and technical fields.

Hypothesis 4: Academics will be more likely to be P's than practitioners. This hypothesis was not well supported except for de Waele's small samples of management scientists and academics:

	N	SE - ST	NS - SN	ST - SF	TS - TP
Academics	23	31 - 69	15 - 85	69 - 31	58 - 42
Industry	26	35 - 65	38 - 62	73 - 27	77 - 23

Both are mainly J's; however, the practitioners ("industry") contain a higher fraction. The difference shown in de Waele's data is just significant ( $p .10$ ) and requires more study. The data in Table 4 presents a somewhat different picture. The technical professionals, business professionals (functional and managerial), and academics are

J's; the only exception being middle managers who are P's. The fact that the middle managers' P score disrupted the steady J trend for technical and business professions as well as academics was initially surprising. However, further examination of the data causes the emergence of interesting significance levels. Most of the "practitioners" (seven out of the eleven professional groups in technical business fields) are significantly different from the MBA base population; that is, they are significantly stronger J's (four at the .001 level, one at the .01 level, and two at the .05 level) than the MBA's. The remaining "practitioners" (industrial management scientists, Bell Lab Supervisors, and bank managers) as well as the academics are not significantly different from the MBA's. There are at least two possible explanations for this discrepancy:

1. The "weaker" J groups and middle managers (P's) may work in environments that demand less structure than the "stronger" J's environments and/or
2. the weaker J, as well as the P groups, may be comprised of more MBA's, thereby lowering the J score. Both explanations are conjecture and will require further research. (Additionally, it requires that researchers request complete education backgrounds of subjects being tested.)

Hypothesis 5: Managers will be predominantly T's and J's. The data confirms that managers are predominantly T's. Middle managers and senior executives were not significantly different than MBA's on the T scale, while manager/owners were significantly stronger T's ( $p < .01$ ). The data confirms that managers are predominantly J's. Senior executives and manager/owners are mostly J's, significantly more so ( $p < .001$ ) than MBA's. However, the middle managers' scores provide a discrepancy.

As previously stated, the middle managers are P's, and differ significantly ( $p < .001$ ) from the MBA's. It is plausible that senior executives and managers/owners would prefer a more structured environment; it appears that the more a job involves decision making, the higher the fraction of J's it contains. The senior executives are 83% J's; they are closer to the judges in overall profile than to other managerial levels. Senior management is clearly a field for J's. However, MBA's are weaker J's and middle managers are P's. Whether this is a result of less and/or different decision making responsibility is in need of further research.

Hypothesis 6: Individuals whose work involves close contact with others will be S's and F's. The data in Table 5 support this hypothesis. It is not surprising that service professions (health, education, and counseling), intellectual fields (creative writers, Rhodes scholars, and theologians) and college teaching attract F's. However, limited information and limited samples make formal tests of significance not possible. It is also not surprising that the sales/customer relations profession, the group in the business field who has the most people contact, is mainly F's. The virtual absence of technical and managerial fields in which F's are a majority limits comparison. It is, however, obvious that the world of MIS, in terms of development and use of information systems, is not one in which many F's are found. NT managers and analysts have many strengths. So, too, do the NF's who do not easily fit with them. Examples are shown in Table 6 (these are taken from a range of sources, including Myers, 1962 and 1980).

## CONCLUSION

The above discussion and data support the case for the MBTI as a general base for cognitive style research in MIS. It reasonably meets Bagozzi's tests of validity:

Table 6

<p>Characteristics: visionary, always needs to be conceptualizing</p> <ul style="list-style-type: none"> <li>- prides self on technical know how</li> <li>- likes to model</li> <li>- has difficulty with communication</li> <li>- not a natural appreciator of others</li> </ul> <p>Strengths: architect of change</p> <ul style="list-style-type: none"> <li>- x-ray vision</li> <li>- intellectual grasp</li> </ul> <p>Weakness-likes to plan, wants other to build</p> <ul style="list-style-type: none"> <li>- focuses on principles, ignores others feelings</li> </ul>	<ul style="list-style-type: none"> <li>- catalyst, leader</li> <li>- draws out best in people</li> <li>- enthusiastic spokesman</li> <li>- committed to progress of surrounding people</li> <li>- charisma</li> <li>- commitment</li> <li>- listens</li> <li>- patience with complexity</li> <li>- easily burnt-out</li> <li>- too attuned to others' feelings: tries to please</li> <li>- may make decisions based on own likes and dislikes</li> </ul>
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1. Conceptual validity: The wealth of applications of the MBTI and the discussion of Psychological Type in relation to information use and decision aids (Mitroff and Mason, Mitroff, 1975 and de Waele) provide a strong conceptual base.
2. Construct validity: The MBTI seems methodologically sound in this respect. It must be acknowledged, of course, that personality and trait-based theories in general and style models in particular are contentious and in some respects the preference for a particular psychological tradition is a matter of axioms and taste. Shouksmith (1970) provides a useful summary of the case for and Nisbett and Temoshok (1976) provide more specific summary of the case against personality-focussed cognitive models.
3. Convergent,
4. Discriminant, and
5. Predictive validity: Here the MBTI scores strongly, especially in comparison with competing models of style.
6. Nomological validity: The MBTI relates to a broad, rich conception of both personality and behavior across a wide range of contexts

including data on learning, occupational, interpersonal behavior, organizational needs, and problem solving. Many other cognitive style models have both a limited domain of applicability and a narrow conception of cognition and behavior.

Witkin's model of field independence is the only other widely supported alternate paradigm for MIS research. This is not a survey paper nor is there any wish to make the case for the MBTI at the expense of the EFT. The field independence model has been widely applied in both MIS and accounting research (Lusk, 1973, 1979). Benbasat and his colleagues have used it in a series of experiments over a number of years. Since there clearly is no single cognitive style, the EFT and MBTI can peacefully coexist. However, the general case for the Witkin model and measure needs to be made in basically the same terms as that for the MBTI in this paper. The validity of the EFT needs to be demonstrated.

Taggart and Robey point out that despite criticisms of the EFT "the general documentation of the test's development leaves little doubt that a fundamental personality construct underlies the measure (1979). The issue is, "is this the construct MIS research is interested in?"

The main arguments against the EFT in this context are:

1. Conceptual validity: it is difficult to see how a simple bi-polar model based on performance in tasks that focus on spatial skill can adequately capture complex cognitive processes. A major conclusion of this paper is the need for a two-dimensional construct that distinguishes information-gathering and information-evaluation. The MBTI results shown in Table 5 sug-

gest that even two dimensions may not be enough.

In addition, cognitive "style" is a broad theory and the Witkin measure a narrow one. Nisbett and Temoshok review Witkin's and his colleagues' experiments (and Broverman's analogous model, 1964, of "automatization") and agree with Zigler, 1963, that "no concept more general than 'spatial decontextualization' can be supported by the data. "We are not the first to view with alarm an unwarranted overgeneralization in the terms employed by Witkin and his colleagues...our data are consistent with the demands of Witkin's critics for a narrower conception of his construct."

Such a conception would not be a general model of cognitive style. Almost none of the researchers who use the EFT discuss the underlying theory; the issue of conceptual validity is essentially ignored.

2. Construct Validity: the EFT is a well established measure of field independence. It is used in MIS as an indicator of "analytic" versus "heuristic" styles. There is no clear basis for substituting these labels (Zigler, 1963). The EFT and related instruments measure performance on a narrow set of simple tasks. It seems inappropriate to use the scores as general indicators of style in experiments examining complex problem solving behavior and information use.
3. Convergent and 4. Validity: The EFT was initially designed for use among school children and college students of average ability. The graduate school subjects of most experiments in MIS using the EFT

or group EFT score too highly to allow reliable discrimination. The maximum score on the GEFT is 18; the report median is around 16, and the average 13. The distributions are extremely skewed. As a result, studies use a simple, arbitrary low-high dichotomy. This obviously limits discrimination, and makes any classification of a subject as "low analytic" or "heuristic" unreliable. The main advantage of the EFT is its simplicity. It seems too simple. There is a lack of statistical data to support any claim for either convergent or discriminant validity in the context of MIS research.

5. Predictive Validity: Taylor and Benbasat (1980) and Taggart and Robey (1979) provide useful summaries of experiments using the EFT in MIS. The results are generally equivocal and often contradictory. For example, Doktor and Hamilton's conclusions (1973) are inconsistent with Benbasat and Dexter (1978) and Lusk (1973) using similar, clear hypotheses. In many instances, some factor other than cognitive style accounts for most of the variance in the results.
6. Nomological Validity. This seems the most limitation. The MBTI relates to a rich psychological model and to wealth of data on learning, occupations, interpersonal behavior, organizational needs, etc. Witkin and his colleagues have studied relationships between field dependence/independence and many of these factors. Their discussions of interpersonal behavior (Witkin & Goodenough, 1977) and education (Witkin, et al., 1967) are thorough and useful. However, they do not relate to the managerial and organ-

izational context of interest to MIS. Whereas there is a range of MBTI data on managerial behavior, occupational choice, turnover, teamwork, values, and educational level, the general validity of the Witkin model rests on the results of a number of small scale experiments rather than large scale, heterogeneous surveys. The Witkin model is a narrow one and far less rich in its implications than the MBTI. That is not necessarily a weakness, but it makes it seem less suitable than the MBTI for MIS; the overall aims of MIS research in this context are general and ambitious; to establish that the psychology of individual differences is a major explanatory factor for all aspects of information systems. Regardless of empirical results, no paper with the scope, bravura, and intellectual depth of Mason and Mitroff's could be written around the EFT, nor could Mitroff and Kilmann's study of ideal organizations be obtained from a low/high dichotomy.

The overall case for EFT has not been made as yet. If it can be, the EFT may be better suited to studies of the psychology of individual cognitive differences where performance rather than preference or behavior is the focus of interest than is the MBTI. Until the case for the validity of the EFT is made, however, it is hard to see that further, simple experiments around "analytic" and "heuristic" styles can be justified.

The adoption of the MBTI as the central instrument for MIS research on cognitive style permits an integrated, cumulative research effort. That the cognitive style paradigm continues to interest a large number of MIS researchers despite the obvious flaws in and fragmentation of existing efforts indicates its potential impor-

tance. The relationship between information and information-processor is obviously at the heart of MIS. A common and valid construct and measure will make it easier to translate potential into actual. This can begin from the further consolidation and comparison of the results of existing studies, especially in linking the data on information use and that on occupational differences. A systematic method for reporting MBTI results is essential; the use of letters and percentages is convenient and acceptable, but there has been a tendency to ignore statistical analyses in the MBTI literature.

Once the comparative studies demonstrate that the two central hypotheses of the cognitive style approach are well-supported, a major aim of the overall research effort will have been accomplished. These hypotheses are simple:

1. Cognitive style differences have a major impact on information systems and implementation.
2. Managers and analysts are different (or, if the arguments and data presented in this paper are correct, some managers are different from the analysts).

Selecting a valid method for studying them has not been simple. The issue of validity has to be resolved. The MBTI seems to offer an excellent solution.

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## Appendix A. Sources of Data Reported in Table 5

Data	Source
<u>1. Baseline Figures</u>	
Center for Applications of Psychological Type	CAPT
Combined MBA Samples	Keen & Bronsema
<u>2. Technical Fields</u>	
Engineering undergrads	Myers
Engineering graduates	Meyers
Data processing professionals	Keen & Bronsema
Office automation specialists	Keen & Bronsema
Industrial management scientists	de Waele
Bell Labs supervisors	Keen & Bronsema
<u>3. Scientific Fields</u>	
Science students	McCaulley
Research scientists	McKinnon
<u>4. Intellectual Fields</u>	
Creative writers	McKinnon
Rhodes Scholars	Myers
Theology	Myers
Creative architects	McKinnon
Mathematicians	McKinnon

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5. Business

(a) Functional Areas

Accountants	Myers
Bank Employees	Myers
Sales/customer relations	Myers
Bank managers	Keen & Bronsema
Marketing managers	de Waele
Management consulting	Wade

(b) Managerial level/training

Wharton undergrads	Myers
Middle managers	Keen & Bronsema
Senior executives	Keen & Bronsema
Owner/managers of small firms	Hay

6. Service Professions

Health-related	Myers
Education	Myers
Counselling	Myers

7. Academics

Business school faculty	Keen & Bronsema
Academic management scientists	de Waele
College teachers	Myers

8. Law

Graduate law students	Myers
State judges	Keen & Bronsema

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